

each nanoparticle comprising a sequence complementary to the sequence of at least two portions of the nucleic acid;

contacting the nucleic acid and the nanoparticles under conditions effective to allow hybridization of the recognition oligonucleotides on the nanoparticles with the two or more portions of the nucleic acid; and

observing a detectable change brought about by hybridization of the recognition oligonucleotides on the nanoparticles with the nucleic acid.

315. A method of detecting nucleic acid having at least two portions comprising:
contacting the nucleic acid with at least two types of nanoparticles according to any one of Claims 253-263 having recognition oligonucleotides attached thereto, the recognition oligonucleotides on the first type of nanoparticles comprising a sequence complementary to a first portion of the sequence of the nucleic acid, the recognition oligonucleotides on the second type of nanoparticles comprising a sequence complementary to a second portion of the sequence of the nucleic acid, the contacting taking place under conditions effective to allow hybridization of the recognition oligonucleotides on the nanoparticles with the nucleic acid; and

observing a detectable change brought about by hybridization of the recognition oligonucleotides on the nanoparticles with the nucleic acid.

316. The method of Claim 315 wherein the contacting conditions include freezing and thawing.

317. The method of Claim 315 wherein the contacting conditions include heating.

318. The method of Claim 315 wherein the detectable change is observed on a solid surface.

319. The method of Claim 315 wherein the detectable change is a color change observable with the naked eye.

320. The method of Claim 319 wherein the color change is observed on a solid surface.

321. The method of Claim 315 wherein the nanoparticles are metal nanoparticles or semiconductor nanoparticles.

322. The method of Claim 321 wherein the nanoparticles are made of gold.

323. The method of Claim 315 wherein the recognition oligonucleotides attached to the nanoparticles are labeled on their ends not attached to the nanoparticles with molecules that produce a detectable change upon hybridization of the recognition oligonucleotides on the nanoparticles with the nucleic acid.

324. The method of Claim 323 wherein the nanoparticles are metallic or semiconductor nanoparticles and the recognition oligonucleotides attached to the nanoparticles are labeled with fluorescent molecules.

325. The method of Claim 315 wherein:
the nucleic acid has a third portion located between the first and second portions, and the sequences of the oligonucleotides on the nanoparticles do not include sequences complementary to this third portion of the nucleic acid; and

the nucleic acid is further contacted with a filler oligonucleotide having a sequence complementary to this third portion of the nucleic acid, the contacting taking place under conditions effective to allow hybridization of the filler oligonucleotide with the nucleic acid.

326. The method of Claim 315 wherein the nucleic acid is viral RNA or DNA.
327. The method of Claim 315 wherein the nucleic acid is a gene associated with a disease.
328. The method of Claim 315 wherein the nucleic acid is a bacterial DNA.
329. The method of Claim 315 wherein the nucleic acid is a fungal DNA.
330. The method of Claim 315 wherein the nucleic acid is a synthetic DNA, a synthetic RNA, a structurally-modified natural or synthetic RNA, or a structurally-modified natural or synthetic DNA.
331. The method of Claim 315 wherein the nucleic acid is from a biological source.
332. The method of Claim 315 wherein the nucleic acid is a product of a polymerase chain reaction amplification.
333. The method of Claim 315 wherein the nucleic acid is contacted with the first and second types of nanoparticles simultaneously.
334. The method of Claim 315 wherein the nucleic acid is contacted and hybridized with the recognition oligonucleotides on the first type of nanoparticles before being contacted with the second type of nanoparticles.
335. The method of Claim 334 wherein the first type of nanoparticles is attached to a substrate.